

Further experiments on the temporary social parasitism in ants
of the genus *Lasius*, Fab., with a note on *Antennophorus*
uhlmanni.

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While staying at Seaton, Devon, last summer, I was able to procure a number of naturally-declated or freshly-fertilised ♀ ♀ of *Lasius niger* and *L. umbratus*, after a marriage-flight of these two species on September 15th.

In dealing with ants of this genus, I prefer to use fertile ♀ ♀, as though I have made experiments with artificially-declated ♀ ♀ of *umbratus*, two of which were permanently adopted by queenless colonies of *L. niger* (Extr. 2nd, Intern. Cong. Ent., Oxford, 1912), the ♀ ♀ never behaved like fertile ♀ ♀, were always restless, and attempted to escape from the nest. The number of experiments to be described was necessarily limited, since I had only three colonies of *L. niger* in my possession at the time, and I was afraid that the ♀ ♀ of *L. umbratus*, which, unlike those of *niger*, *alienus*, and *flavus*, are very hard to keep alive in captivity without ♂ ♂, would not survive the delay necessary to establish fresh colonies of the host species in artificial nests. The experiments, nevertheless, give additional proof of the parasitic habits of *L. umbratus*, eliminate the possibility of ♀ ♀ of the two species combining to found colonies, and suggest a method by which the host queen, if present, may be destroyed by the parasitic queen. The ♂ ♂ and ♀ ♀, some winged and others already declated, began to appear on the roads about 2.0 p.m. on September 15th. One declated *umbratus* ♀ was seen to enter a hole under a wall, which proved to be one of the entrances to a nest of *L. niger*, the host species.

Three *umbratus* ♀ ♀, still winged, and a ♂, were confined together overnight; in the morning the ♂ and one ♀ were dead, the latter cut up into three pieces, head, thorax, and abdomen. One colony of *L. niger* that swarmed on September 15th, had already been observed to swarm earlier in the summer, July 14th.

A. Experiments with a colony of *L. niger*, dating from 1911, containing over 1,000 ♂ ♂, queen, and brood (nest number, 40).

Exp. 1. September 15th, 1912.—An artificially declated *L. umbratus* ♀ was placed in the fourth or outer chamber of nest 40. She at once entered the next chamber, which was dark, was surrounded by ants, and taken into chamber two. Many ants attacked her, though a few saluted. She made no attempt at resistance, and before long was dead.

Exp. 2.—Soon after Exp. 1 an artificially declated *L. niger* ♀ was placed in the outer chamber of nest 40. She was at once attacked and eventually killed. There were no signs of friendliness. This only confirms numerous experiments, which seem to show that this species will never accept strange ♀ ♀ of its own kind.

Exp. 3. September 17th, 1912.—A naturally declated (*i.e.*, fertilized) *L. umbratus* ♀ was placed in the outer chamber of nest 40, the entrance to the other chambers having been closed. There were nine ♂ ♂ with the ♀, all of which were friendly to her. Two days later, all still being on good terms, the barrier to the other chambers was removed. A few fresh ants attacked, but others saluted the ♀. Later she was held by both antennæ and two legs, and as it was evident she would be killed, I removed her.

B. Experiments with a small incipient colony of *L. niger*, founded in 1911, consisting of about 100 ♂♂, queen and brood, (nest 42).

Exp. 4. September 15th, 1912.—An artificially deälated *L. umbratus* ♀ was placed in the outer chamber of the nest. Several ants came to her, and were greatly excited, but not hostile. She remained motionless whenever an ant touched her. After ten minutes she entered the dark chamber of her own accord, but was attacked and soon held by every limb. Next day she was dead.

Exp. 5. September 16th, 1912.—A naturally deälated *L. umbratus* ♀ was isolated in a glass tube with one ♂ from nest 42. After some time she killed the ♂. Next day the tube was opened and placed inside the nest. The ♀ came out, entered the inner chamber and patiently submitted to the attacks of a few ♂♂. The *L. niger* ♀ then came up to her and saluted her, and kept returning and saluting her for several hours, caressing the intruder with her antennæ. Some ♂♂ saluted her also, but later in the afternoon she was fiercely attacked and so badly injured that I removed her.

Exp. 6. September 17th, 1912.—Another naturally deälated *umbratus* ♀ was confined in the outer chamber of nest 42 with a few ants, who at first attacked her; some hours later they were all on friendly terms. In the evening of the 18th I removed the barrier to the inner chamber, but on returning after twenty minutes found the ♀ nearly dead.

C. Experiments with a small colony of *L. niger* consisting of about 200 ♂♂ and larvæ, but no queen (nest 41).

Exp. 7. September 16th, 1912.—Two ♂♂ from this nest were confined in a tube with a young fertile ♀ of *L. umbratus*, who immediately killed one of them, and attempted to catch the other. I then put another ♂ in the tube. Some time afterwards both ♂♂ were killed. Next afternoon I placed the tube in the nest. The ♀ remained in the tube, but several ♂♂ visited her and examined her without any hostility. Presently she came out of the tube surrounded by ants, some of which saluted her, and entered the inner chamber, where she walked quietly about, only one or two ♂♂ showing any hostility. In about an hour's time, however, there was a complete change in the attitude of the ants, and they began to attack her with great animosity. Eventually, when she was nearly dead, I removed her.

In this case it is conceivable that in the process of killing the three *niger* ♂♂, the ♀ acquired the "nest aura," which, however, wore off in about an hour.

Exp. 8. September 18th, 1912.—I confined a naturally deälated ♀ of *L. niger* in the outer chamber of nest 41, with a few ♂♂. Unlike the *umbratus* ♀♀ she avoided these ♂♂ as much as possible. Some hours later there was a dead ♂ on her foreleg. Next morning as she was still uninjured, and a few ♂♂ saluted her, I removed the barrier to the inner chamber. She entered of her own accord, but immediately reappeared and tried to escape from the nest. After sometime she again entered the inner chamber, but was seized by an antenna and presently attacked on all sides. By 2.0 p.m., she was dead.

Exp. 9. September 19th, 1912.—I confined, as before, a naturally dealated *L. umbratus* ♀ in the outer chamber of the nest with ten ♂ ♂. She was not attacked at all during the day. Next afternoon I removed the barrier and she very soon entered the inner chamber, where she was seized by three legs and an antenna. At the same time however other ants saluted her. In the evening she was nearly dead, but no longer attacked. Occasionally ants saluted and licked her. She was in such a weak state that I did not think it possible for her to recover, so I left her in the nest. Next morning she had recovered to a certain extent and was able to walk about slowly, though one antenna was badly twisted. No ants attacked her, and in fact she appeared accepted. On the 22nd she had completely recovered, the only trace of the rough treatment she had undergone being her bent antenna. At the moment of writing (March 1913) she is in perfect condition and surrounded by a court of ♂ ♂. Thus it was only in a small queenless colony that the parasitic ♀ was accepted, but in all the nests, so long as the number of ♂ ♂ was small, the ♀ was not attacked. It is conceivable therefore that in nature a ♀ might enter an outlying part of a nest, and be gradually accepted by most of the ♂ ♂ until she was able to enter the nest proper.

No cases are known of the host queen and the parasite living together in a nest, so, unless a ♀ can only be adopted by a queenless colony, it must sometimes happen that a ♀ is accepted by a colony already possessing a queen of its own species. In such a case the intruder must either kill the rightful queen herself, as the queen of *Bothriomyrmex* kills the queen of her host, *Tapinoma nigerrimum*, or the ♂ ♂ of the host species must themselves assassinate their own queen, as do the ♂ ♂ of *Tetramorium caespitum* when they have accepted a ♀ *Anergates atratulus*. (Extr., 2nd Int. Cong. Ent. Oxford, 1912.)

In order to throw some light, if possible, on this problem I confined several queens of *umbratus* with queens of *niger*. The results were striking.

Exp. 10. September 15th, 1912, 7.0 p.m.—A young fertile ♀ of *L. umbratus* and one of *L. niger* were isolated in a tin glass-top box. They avoided each other as much as possible. At 11.0 p.m. the *niger* ♀ was dead.

Exp. 11. September 16th, 1912, 1.0 p.m.—Another pair of young fertile ♀ ♀ were isolated. At 1.40 the *niger* ♀ was nearly dead. The *umbratus* ♀ then came up, and, standing over the *niger*, bit savagely at the pedicel. At 6.10 the *niger* was cut into three pieces.

Exp. 12.—At the same time as the last experiment, another pair of similar ♀ ♀ was isolated. No attacking was observed during the day, but the following morning the *niger* was dead. In this and the previous experiment the ants were confined in glass tubes of half inch bore, stopped by corks. The *umbratus* ♀ ♀ were able to gnaw away the corks to a considerable extent, whereas the weaker mandibles of the *niger* could make no impression on them.

The supply of ♀ ♀ having given out, I was unable to continue these experiments. The last three, however, show that the *L. umbratus* ♀ ♀ will attack *L. niger* ♀ ♀ and are able to kill them easily, in spite of their smaller size, owing to the greater power of their mandibles. A newly-fertilized ♀, then, fortunate enough to come across an incipient colony of *L. niger*, might easily disregard the

attacks of the young first brood ♀ ♀, kill the queen (*cf.* Exp. 14), and be established in her place. If she happened on a queenless colony of *niger*, even a populous one, she might, as I have shown elsewhere (*Science Gossip*, May 1900, N.S., vol. vi., no. 72, p. 365, "Alien Queen Ant;" *Ent. Mo. Mag.*, 2nd ser., vol. xx., p. 94, 1909; *Trans. Ent. Soc. Lond.*, Parts iii. and iv., p. 657, 1909; etc.), readily be adopted by the ♀ ♀.

I also made the following three experiments with colonies of *L. umbratus* and *L. flavus*.

Exp. 13. September 17th, 1912.—I isolated a young fertile *umbratus* ♀ and gradually introduced *umbratus* ♀ ♀ from an old mixed colony of *niger* and *umbratus*, with queen and brood of the latter species, dating from 1908 (nest 11). The ♀ ♀ were excited and some attacked her. She was attacked from day to day and finally killed.

Exp. 14. September 17th, 1912.—A young fertile *umbratus* ♀ was placed at the entrance to a nest of *L. umbratus* with two *L. fuliginosus* queens and *fuliginosus* brood (nest 33, dating from 1910). She entered the nest, but was attacked by the first ♀ ♀ that met her. She walked on with her assailants hanging to her legs until she reached one of the queens. She immediately sprang on the back of the queen and seized her by the pedicel, the favourite point of attack. Being hampered by the ♀ ♀, she was unable to hold the queen, who escaped. Later in the day the intruder was killed.

Exp. 15. September 17th, 1912.—Another young fertile *umbratus* ♀ was put into a nest of *L. flavus* with queen. She was attacked and killed.

Experiment 14 is an admirable illustration of what I take to be the mode of attack when the intruder meets the rightful queen of the nest. In Experiment 5, however, the *umbratus* ♀ made no attempt to attack the queen, who was persistently friendly to her.

NOTE ON ANTENNOPHORUS UHLMANNI.—The following occurrence shows that ants, though unable to injure the hard bodies of these semi-parasites with their mandibles, yet can easily kill them with formic acid. Ants of most species, however, have a great reluctance to making use of their poison in the recesses of the nest, as in a confined space the acid is fatal to the users themselves. In December, 1911, I removed an *Antennophorus* from a ♀ of *L. umbratus* and placed it on its back on a slide. It vainly attempted to right itself by using its long forelegs as levers. I then held an ant close to the *Antennophorus*, which seized the ant's foreleg and ran with incredible rapidity along the ant's body, finally returning to the underside of the head, the usual position. I then again attempted to remove the *Antennophorus*, but the ant, held by my forceps, began to struggle, and a drop of formic acid appeared at the tip of its abdomen. The *Antennophorus* came into contact with the acid, dropped off the ant, and expired instantly.

Though the ants sometimes feed these commensals, an ant will always struggle violently for some time after one has fixed itself on her, and an ant which bears an *Antennophorus* never seems to leave the inner chambers of the nest. It seems fairly clear that the ants only tolerate these tenacious *Acari* because their mandibles are not powerful enough to remove them, and they are not sufficiently intelligent to employ their formic acid to rid themselves of their embarrassing burdens.